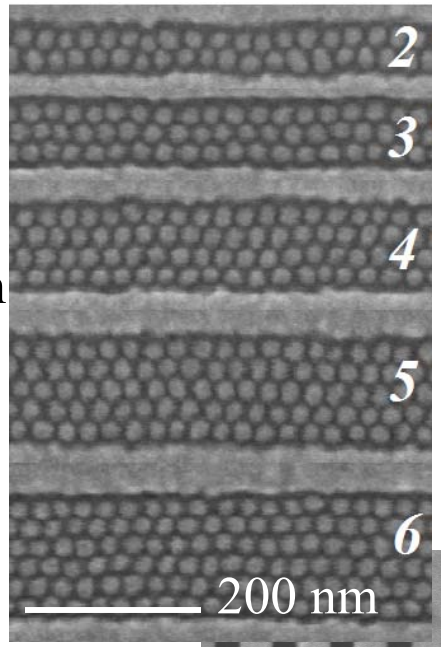
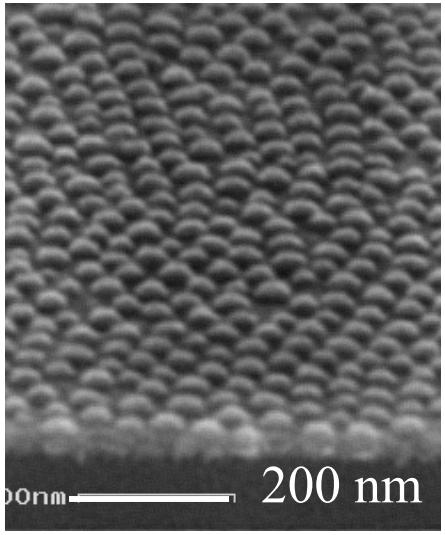
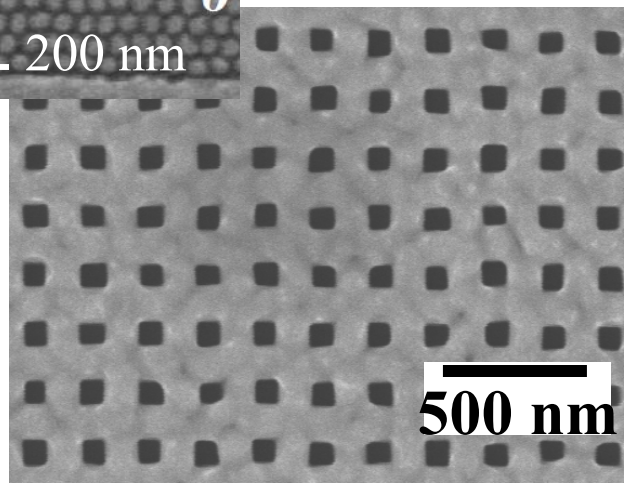
Nanostructured Surfaces with Long-range order for Controlled Self-Assembly

C.A. Ross, H.I. Smith, C.V. Thompson, F.M. Ross; MIT and IBM, DMR0210321, 8/1/2002 – 7/31/2006

This project develops methods and processes to **control the position and geometry of arrays of nanostructures over large areas with precise long-range order** ("templated self-assembly"). An example is the formation of domains in block copolymers, which can be templated by shallow substrate grooves (top left). These materials can be used as lithography masks to make, for example, arrays of magnetic dots for data storage (top right). We are also looking at other examples of self-assembly, including SiGe quantum dot growth, ordering of the pores in anodic alumina (bottom), and the islanding of metal films, all of which can be templated by appropriate substrate patterning.







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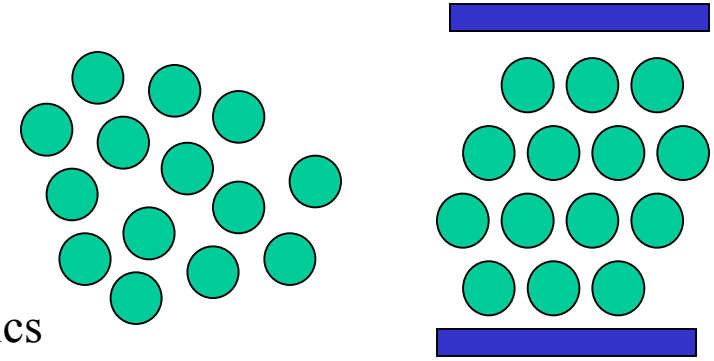
Education:

Two graduate students (Mike Walsh, Amanda Gierman) and two postdocs (Joy Cheng and Kornelius Nielsch) have been supported, plus an undergraduate researcher (Mariana Shnayderman). Work has been highly interdisciplinary, e.g. Kornelius spent time at IBM performing measurement of quantum dot growth in an in situ microscope.

Outreach:

Working with Felice Frankel, a science communicator/artist at MIT, Mariana has developed a set of animations designed to explain the concept of templated self-assembly to the public. See http://web.mit.edu/dmse/ross/nanomovies.htm



Left: self assembly; right: templated self assembly. Graphics from animations.